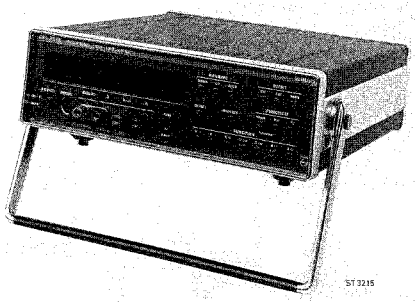
Automatic RMS Multimeter
PM2528

Repair by Signature Analysis

Instruction Manual

9499 473 00211
830304



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REPAIR BY SIGNATURE ANALYSIS

1. GENERAL

For repair by signature analysis a testrom has been developed.
This testrom enables the user to test the digital part of the PM2528 by means of signature analysis.
It also enables trouble-shooting at component level in the circuit under test, by comparing the actual signature to the correct one. So the trouble-shooter can trace back the faulty node.
In total there are 13 tests. In the testrom 12 tests have been implemented and one test is made with the help of the free run facility of the PM2528.

2. WHY USE A SIGNATURE ANALYSER?

Thanks to the microcomputer in the digital part of the PM2528 the instrument can be very small.
Due to this the bus structure is very complex. Data flow on the bus becomes complex and cannot be analysed with an oscilloscope and voltmeter any longer. Therefore the need to test and service the digital part is acute.
The trouble-shooting involves the detection of circuit failure and the localization of faults at the source.
Finding the fault source in a bus system, such as the bus in the PM2528, with complex feedbacks can be difficult. But opening the feedback paths and using the signature analyser makes fault-finding easy.

3. CHECK WITH A SIGNATURE ANALYSER

The signature analyser checks the digital part of the PM2528 by detecting the bit stream at various circuits nodes, and displaying them as hexadecimal signatures.
To do this the PM2528 supplies the signature analyser with three gating signals, or in some cases four:
START, STOP, CLOCK and QUALIFIER.
START signals the beginning of a measurement and prepares the signature analyser to receive information from the data probe. STOP closes does this measurement. In cases of measuring signatures with RC delays, a QUALIFIER has to be used to stop the incoming information for a short period of time. The CLOCK is the system clock of the PM2528 under test to accept the data synchronously.

NOTE: The active edge of each of these gating signals must be selectable.

4. TYPE OF SIGNATURE ANALYSER TO BE USED?

The signature analyser to be used in combination with the PM2528 should have the following capabilities:

- Selectable edges of; START, STOP, CLOCK and QUALIFIER.
- Signatures in the following sequence:

DIGIT	DISPLAY	DIGIT	DISPLAY
0000	0	1000	8
0001	1	1001	9
0010	2	1010	A
0011	3	1011	C
0100	4	1100	F
0101	5	1101	H
0110	6	1110	P
0111	7	1111	U

5. BRIEF DESCRIPTION OF THE TESTS

FREE RUN TEST

With this test it is possible to measure signatures on the address latches and the data bus of the microcomputer. This is necessary to check if the data can be taken from the testrom.

TEST 0 (Ram and I/O test of the μp)

This test checks the internal RAM of the microcomputer. When the RAM is correct, it will also test the I/O parts of the microcomputer. Only then can signatures be measured on the I/O parts databus and ROM.

TEST 1 (Visual display/keyboard leds test)

This test fills the display leds and keyboard leds with a certain pattern. In this way a quick display/keyboard test can be made.

TEST 2 (Display/keyboard leds test)

This test sends signatures to the display and keyboard.
The decoding, the 7-segment leds and the key-leds are tested.

TEST 3 (Key test)

This test sends signatures to the keys and reads them back.

TEST 4 (Analog control test)

This test activates the I/O expanders and the relays in the analog section.

TEST 5 (Synchronous mains/adc start circuit test, no S.A.)

This test checks the following signals:

- Synchronous mains/adc start circuit
- Watchdog
- ADC test switch

The μp reads these signals and if correct an indication will be displayed.

TEST 6 (Interrupt controller test no S.A.)

This test checks the following signals:

- Watchdog interrupt
- Interrupt from keyboard
- External start interrupt

The μp reads these signals and if correct an indication will be displayed.

TEST 7 (Galvanic separation test)

This test sends signatures to the galvanic separation.
Before the interfaces are tested this unit should be tested first.

TEST 8 (BCD output PM9292, start $\overline{\text{DVM}}$ test, no S.A.)

This test checks the start $\overline{\text{DVM}}$ (digital voltmeter) signal.
The μp will read this signal and if correct an indication will be displayed.

TEST 9 (BCD output PM9292 test)

This test checks the complete BCD output.

TEST 10 (Analog output PM9254 test)

This test checks the complete analog output.

TEST 11 (IEC-BUS PM9292 test)

This test checks the complete IEC-BUS interface.

6. HOW TO USE THE DOCUMENTATION AND THE TESTROM

This service manual should be used in combination with the service manual of the PM2528. The user of the fault-finding procedure in the PM2528 service manual will be directed to a certain part of the PM2528.
If the fault-finding procedure does not solve the problem, then select a signature analysis test which is associated with the part of the PM2528.
Begin always with the microcomputer, or with the inputs of the integrated circuits, and try to find the faulty node. Bear in mind that when the faulty node has been found, more than one circuit can cause the faulty signature.

7. FAULT-FINDING HINTS

The first thing to do is to get an analysis of what is wrong. If this is not possible get the PM2528 in the free run mode by breaking the bus system between the microcomputer and the ROMs. This is done by removing the ROMs, and using the FREE-RUN simulator.
The microcomputer is now forcing–in some instruction that will cause a repeated increment of the address lines. So at this point the microcomputer is scanning the whole address field.
With START and STOP lines from the signature analyser, both connected to the most significant address bit and triggering on different edges, a measurement will be defined. Connecting the CLOCK line of the signature analyser to the $\overline{\text{ALE}}$ signal of the microcomputer and selecting the edge at which the address is valid, the input probe will get a signature at every address line.

By touching the probe in every test to a logic 1 level, a characteristic signature is obtained. This is the result of shifting ones (logic 1) in for every cycle that occurs while the gate is open. So the characteristic signature can be used to diagnose this condition elsewhere. The logic 0 is always a signature of "0000". Assume there are no bad signatures in the free-run test, then the TESTROM can be placed in the D1810 socket and it is possible to start measuring with test 0.
If an incorrect part can be located with the fault-finding procedure it is recommended to start with the test which is responsible for that fixed part of the PM2528. To do this a special switch has to be used. (Refer to chapter 11.1. at this service manual).

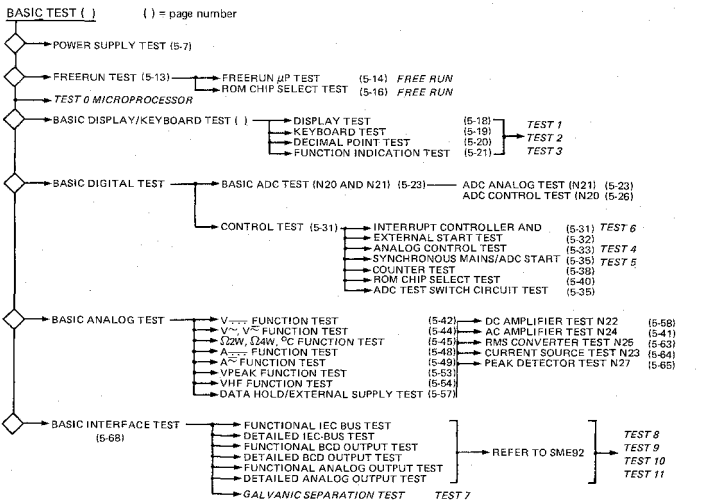
8. HOW TO ORDER THE SIGNATURE ANALYSIS TESTROM AND THE DOCUMENTATION

Under ordering number 5322 694 54015 the testrom and the documentation can be ordered from Concern Service.

9. ADDITIONAL EQUIPMENT TO BE USED

1. Free run simulator (refer to chapter 5.4. of the PM2528 service manual)
   (Free run)
2. Test switch (refer to chapter 11.1. of this manual)
   (test 0 → 11)
3. Test ROM (ordering number 5322 694 54015)
   (test 0 → 11)
4. Two extender printed circuit boards (ordering number 4822 263 70117)

10. FAULT-FINDING FLOW CHART (refer to page 5.4. of the PM2528 service manual)


BASIC TEST ( )
( ) = page number
POWER SUPPLY TEST (5-7)
FREERUN TEST (5-13)
FREERUN µP TEST (5-14) FREE RUN
ROM CHIP SELECT TEST (5-16) FREE RUN
TEST 0 MICROPROCESSOR
BASIC DISPLAY/KEYBOARD TEST ( )
DISPLAY TEST (5-18)
KEYBOARD TEST (5-19)
DECIMAL POINT TEST (5-20)
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BASIC ADC TEST (N20 AND N21) (5-23)
ADC ANALOG TEST (N21) (5-23)
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CONTROL TEST (5-31)
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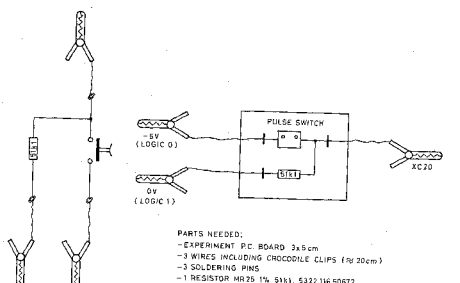
FUNCTIONAL IEC BUS TEST
DETAILED IEC-BUS TEST
FUNCTIONAL BCD OUTPUT TEST
DETAILED BCD OUTPUT TEST
FUNCTIONAL ANALOG OUTPUT TEST
DETAILED ANALOG OUTPUT TEST
REFER TO SME92
TEST 8
TEST 9
TEST 10
TEST 11
GALVANIC SEPARATION TEST TEST 7

NOTE: THE TEST WRITTEN IN ITALICS ARE ADDITIONAL WHICH CAN BE CALLED WHEN USING THE SPECIAL TEST ROM

11. TESTING THE PM2528

11.1. Test switch

To switch from one test to another signal XC20 of the microcomputer has to be connected to logic zero (–5V) every time. However the XC20 input of the μp has no pull-up resistor.
To ensure correct switching a pull-up simulator with e.g. pulse switch should be used.
This may be done in the following way:



PARTS NEEDED:
- EXPERIMENT P.C. BOARD 3x5 cm
- 3 WIRES INCLUDING CROCODILE CLIPS (ø 20cm)
- 3 SOLDERING PINS
- 1 RESISTOR MR25 1% 5kΩ, 5322 116 50672
- 1 PULSE SWITCH 5322 276 14338

ST3801

Before switching on the tests, connect the test switch to the PM2528.

XC20 to test pin XC20
0V to test pin 0V (logic 1)
–5V to test pin –5V (logic 0)

Switch on the PM2528 and select the desired test by pushing the pulse switch. Initial the PM2528 will jump to test 0.

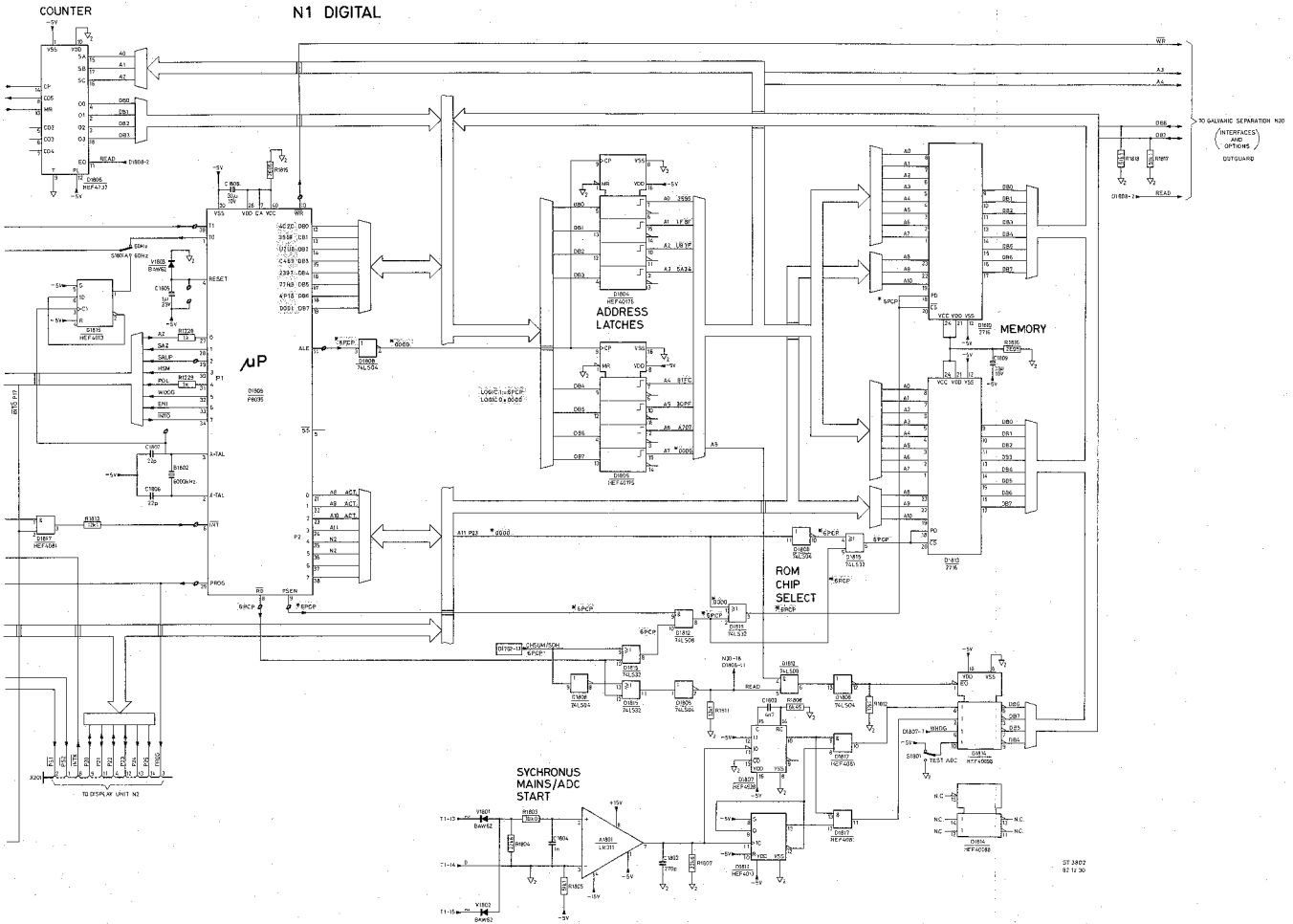
11.2. Free run

Settings signature analyser

Setting	Edge	Test pin	Signal name
START	⌊	D1810/1	ROM / A7
STOP	⌋	D1810/1	ROM /A7
CLOCK	⌊	TP ALE	µp/ALE
QUAL	–	–	
GROUND	–	TP –5V	Logic 0

Preparations

- PM2528
  - Free run simulator placed in D1810 socket (Both ROMs removed). Refer to 5.4. of the PM2528 service manual.
  - Analog control p.c.b. N20 removed.
  - Galvanic separation p.c.b. and interfaces (ANALOG, BCD, IEC) removed.
- Connect the signature analyser as given in the settings table.
- Switch on the PM2528.


N1 DIGITAL
COUNTER
μP
ADDRESS LATCHES
MEMORY
ROM CHIP SELECT
SYCHRONUS MAINS/ADC START
TO DISPLAY UNIT N3
TO GALVANIC SEPARATION N20
INTERFACES AND OPTIONS
OUTGUARD
TEST ADC
ST 3802
82 12 30

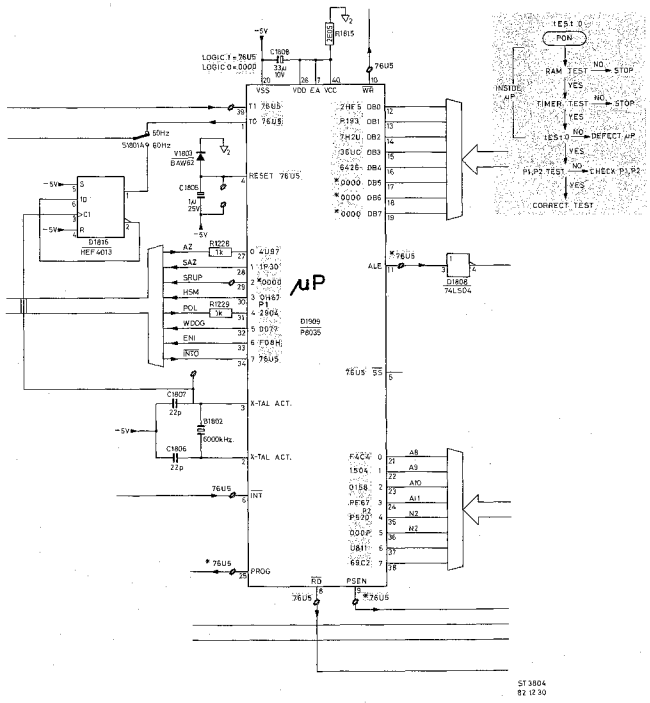
11.3. *TEST 0* Micro processor

Settings signature analyser

Setting	Edge	Test pin	Signal name
START	⌐	TP RUP	µp/P12 (SRUP)
STOP	¬	TP RUP	µp/P12 (SRUP)
CLOCK	⌐	TP ALE	µp/ALE
QUAL	–	–	–
GROUND	–	TP –5V	Logic 0

Preparations

- PM2528
  - Testrom placed in D1810 socket (both ROMs removed).
  - Analog control p.c.b. N20 removed.
  - Galvanic separation p.c.b. and interfaces (ANALOG, BCD, IEC) removed.
- Connect the test switch to the PM2528 (refer to 11.1.).
- Connect the signature analyser as given in the settings table.
- Switch on the PM2528 *TEST 0* will appear on the display if a part of the µp is correct. Refer to the flow-chart in the circuit diagram.

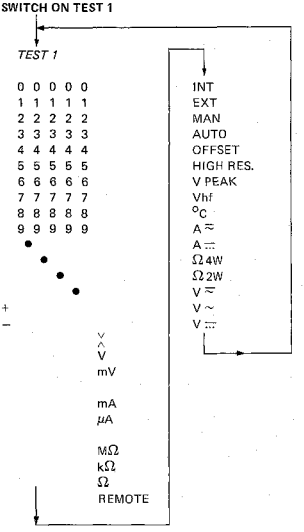


11.4. *TEST 1* Visual display/keyboard (No S.A.)

Preparations

- PM2528
  - Testrom placed in D1810 socket (Both ROMs removed).
  - Analog control p.c.b. removed.
  - Galvanic separation p.c.b. and interface (ANALOG, BCD, IEC) removed.
- Connect the test switch to the PM2528 (refer to 11.1).
- Switch on the PM2528 and select *TEST 1*.

INDICATION



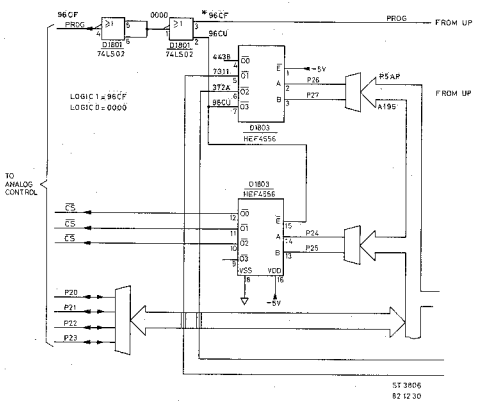
11.5. *TEST 2* Display/keyboard leds test (+ QUALIFIER)

Setting signature analyser

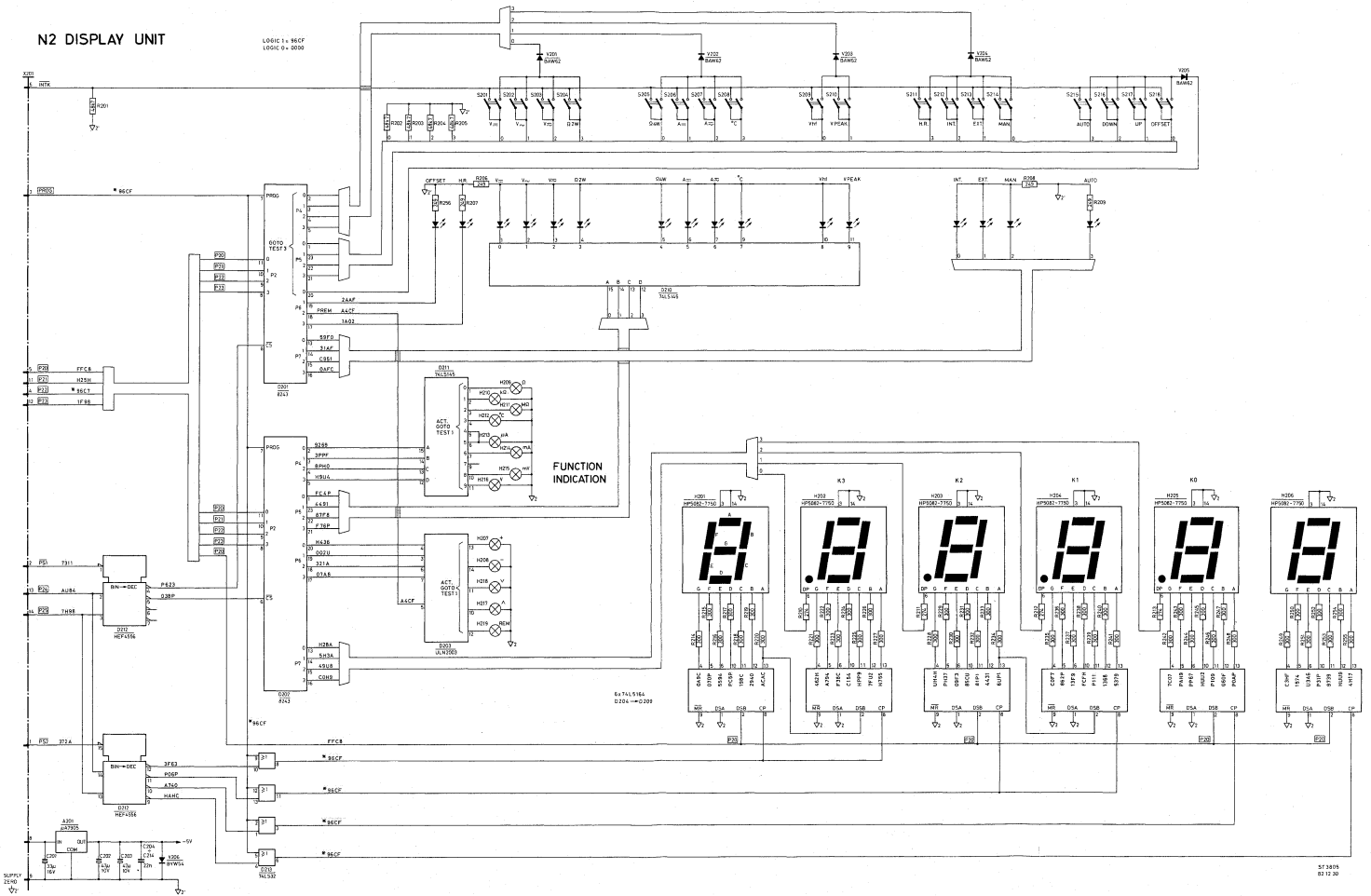
Setting	Edge	Test pin	Signal name
START	↓	TP RUP	µp/P12 (SRUP)
STOP	↑	TP RUP	µp/P12 (SRUP)
CLOCK	↓	TP ALE	µp/ALE
QUAL	↓	N20/12	SAZ
GROUND	–	TP –5V	Logic 0

Preparations

- PM2528
  - Testrom placed in D1810 socket (both ROMs removed).
  - Analog control p.c.b. removed and replaced by extender p.c.b.
  - Galvanic separation p.c.b. and interfaces (ANALOG, BCD, IEC) removed.
  - All analog units may be removed, it is not necessary.
- Connect the test switch to the PM2528 (refer to 11.1.).
- Connect the signature analyser as given in the settings table.
- Switch on the PM2528 and select *TEST 2*.



N2 DISPLAY UNIT



11.6. *TEST 3* Keys

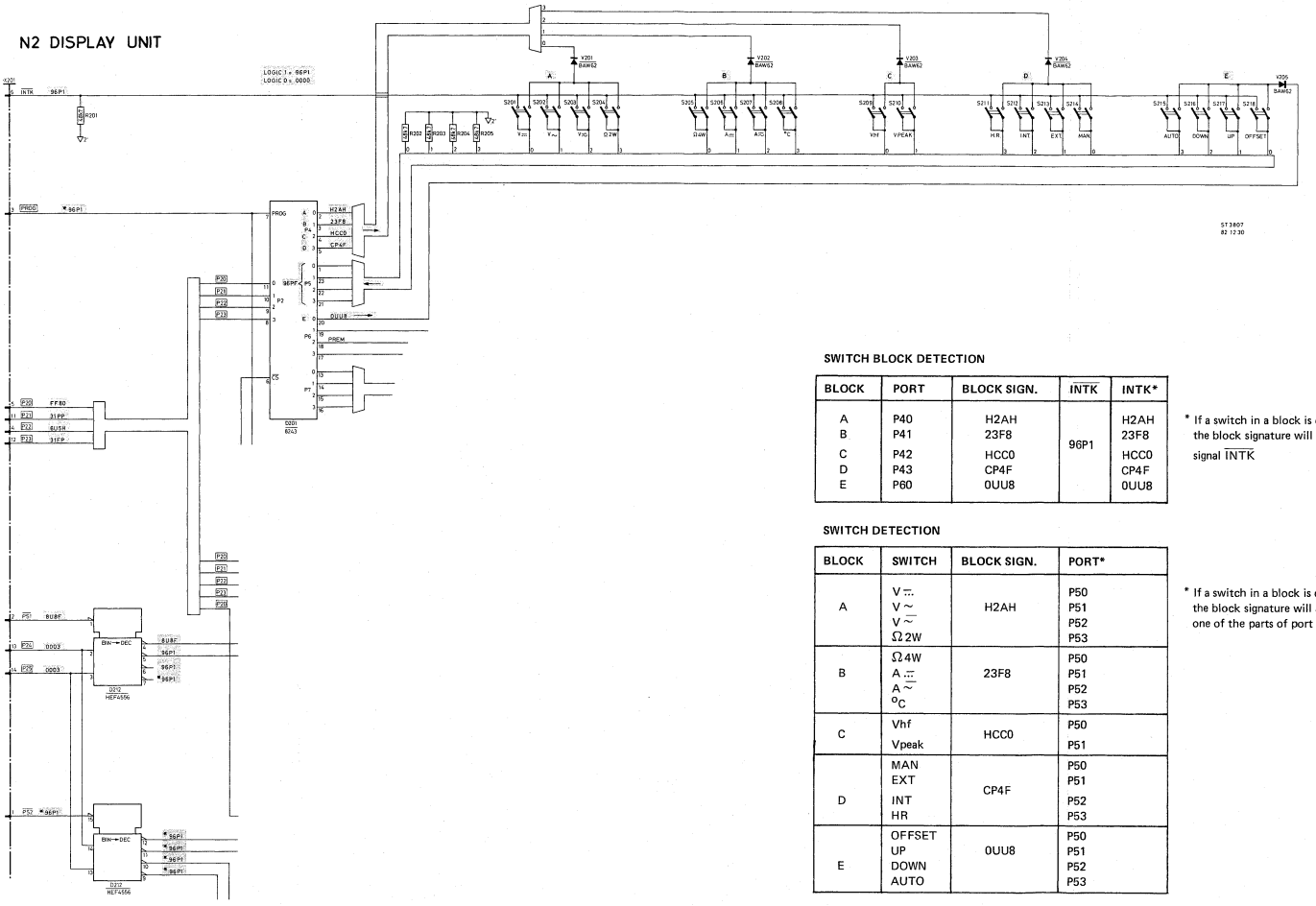
Settings signature alayser

Settings	Edge	Test pin	Signal name
START	⌝	TP RUP	µp/P12 (SRUP)
STOP	⌜	TP RUP	µp/P12 (SRUP)
CLOCK	⌝	TP ALE	µp/ALE
QUAL	–	–	–
GROUND	–	TP –5V	Logic 0

Preparations

- PM2528
  - Testrom placed in D1810 socket (both ROMs removed).
  - Analog control p.c.b. N20 removed.
  - Galvanic separation p.c.b. and interfaces (ANALOG, BCD, IEC) removed.
- Connect the test switch to the PM2528 (refer to 11.1.)
- Connect the signature analyser as given in the settings table.
- Switch on the PM2528 and select *TEST 3* .

N2 DISPLAY UNIT



SWITCH BLOCK DETECTION

BLOCK	PORT	BLOCK SIGN.	INTK	INTK*
A	P40	H2AH	96P1	H2AH
B	P41	23F8		23F8
C	P42	HCC0		HCC0
D	P43	CP4F		CP4F
E	P60	0UU8		0UU8

* If a switch in a block is depressed the block signature will appear on signal $\overline{\text{INTK}}$

SWITCH DETECTION

BLOCK	SWITCH	BLOCK SIGN.	PORT*
A	V⎓	H2AH	P50
	V~		P51
	V~		P52
	Ω2W		P53
B	Ω4W	23F8	P50
	A⎓		P51
	A~		P52
	°C		P53
C	Vhf	HCC0	P50
	Vpeak		P51
D	MAN	CP4F	P50
	EXT		P51
	INT		P52
	HR		P53
E	OFFSET	0UU8	P50
	UP		P51
	DOWN		P52
	AUTO		P53

* If a switch in a block is depressed the block signature will appear on one of the parts of port 5.

11.7. *TEST 4* Analog control (+ QUALIFIER)

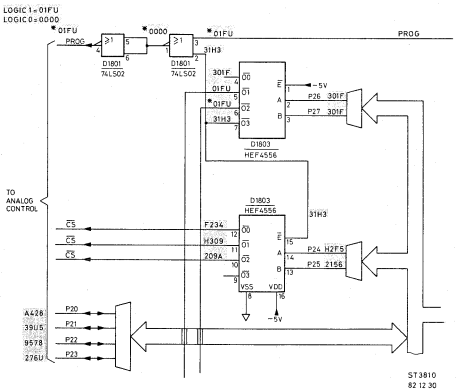
Settings signature analyser

Setting	Edge	Test pin	Signal name
START	⌐	TP RUP	µp/P12 (SRUP)
STOP	¬	TP RUP	µp/P12 (SRUP)
CLOCK	⌐	TP ALE	µp/ALE
QUAL.	⌐	N20/12	SAZ
GROUND	–	–5V	Logic 0

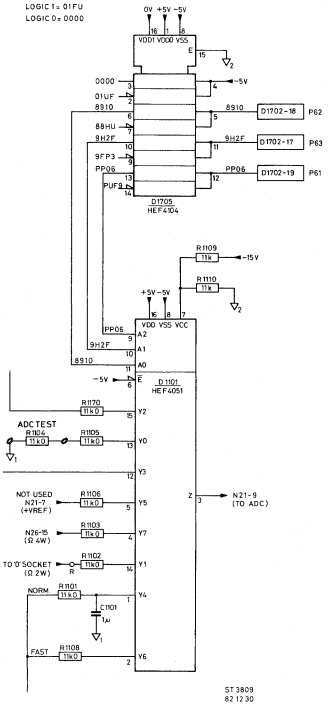
Preparations

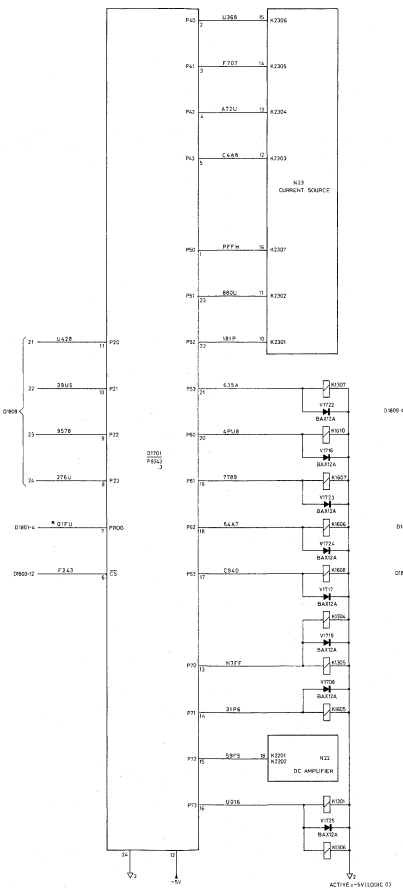
- PM2528
  - Testrom in D1810 socket (both ROMs removed).
  - Analog control p.c.b. N20 removed and replaced by extender p.c.b.
  - Galvanic separation p.c.b. and interfaces (ANALOG, BCD, IEC) removed.
  - Remove all plug-in units.
- Connect the test switch to the PM2528 (refer to 11.1.).
- Connect the signature analyser as given in the settings table.
- Switch on the PM2528 and select *TEST 4.*
- If test 4 is correct, place the current source N23, DC amplifier N22 HF voltage unit N26, RMS convertor N25 and peak detector N27 in the PM2528 again and trace back the signals on the units.

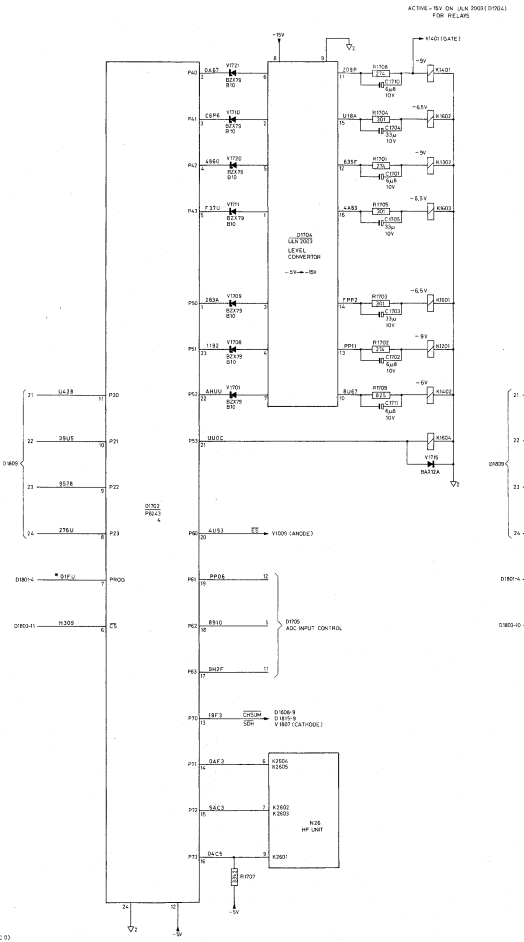
NOTE: Peak detector N27 (PM9259) and HF voltage unit (PM9258) are options.



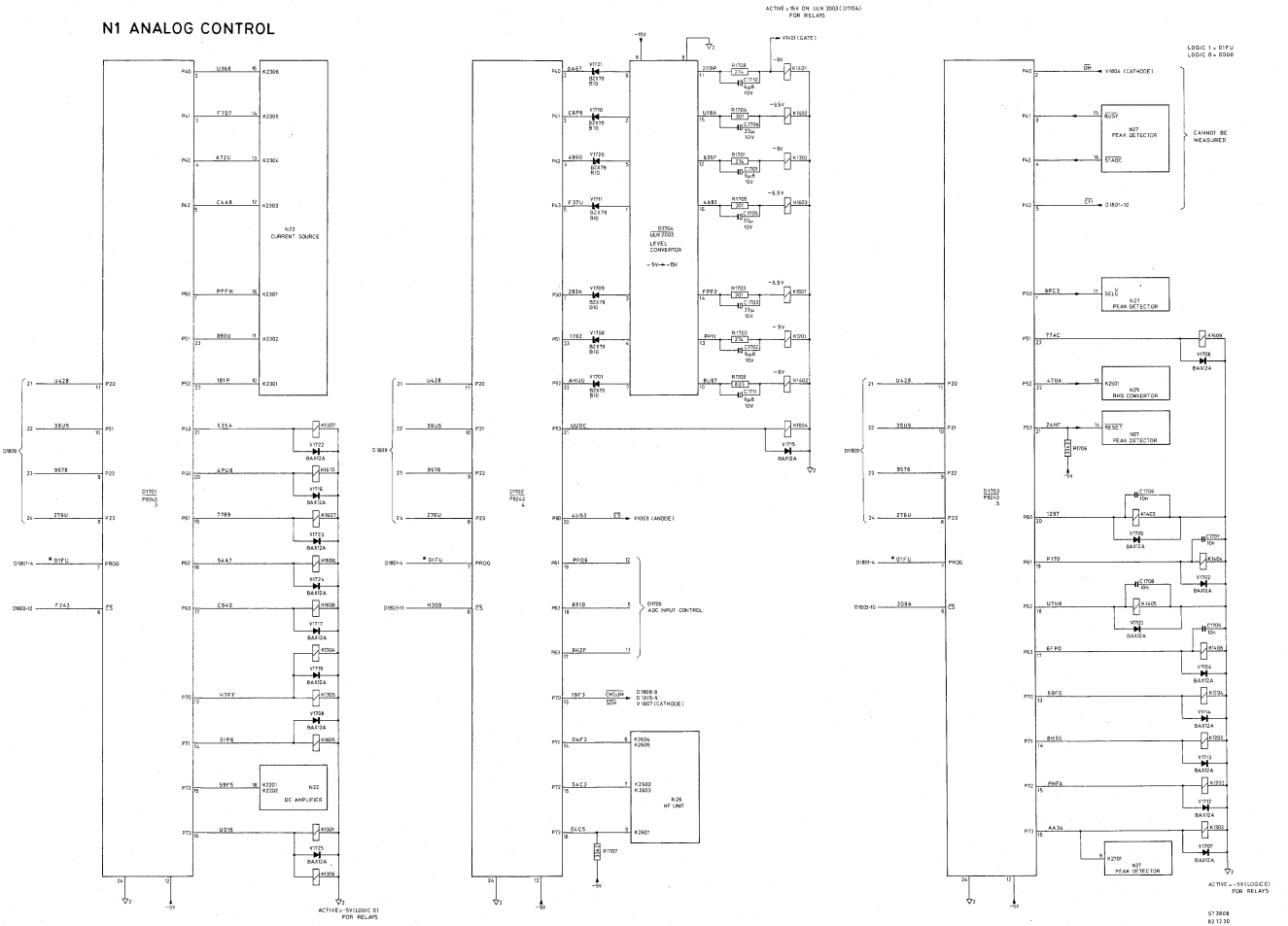
N1 ANALOG CONTROL







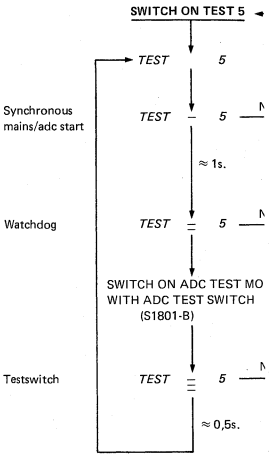
N1 ANALOG CONTROL



11.8. *TEST 5* **Synchronous mains/ADC start circui**

Preparations

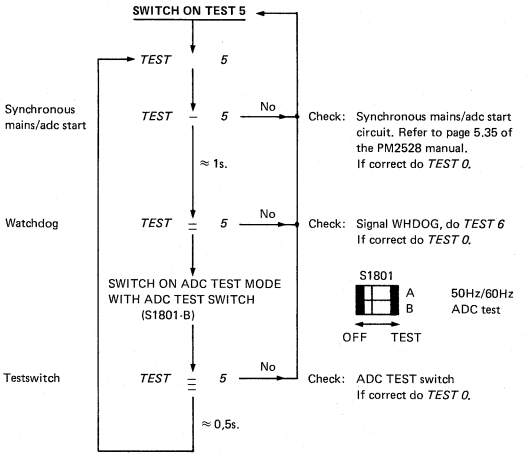
- PM2528 – Testrom placed in soc
  – Analog control p.c.b.
  – Galvanic separation p
- Connect the test switch to the PM2528 (refer
- Switch on the PM2528 and select *TEST 5*.
- Use a data probe or oscilloscope to measure t
  Logic 1 = 0V, logic 0 = –5V.

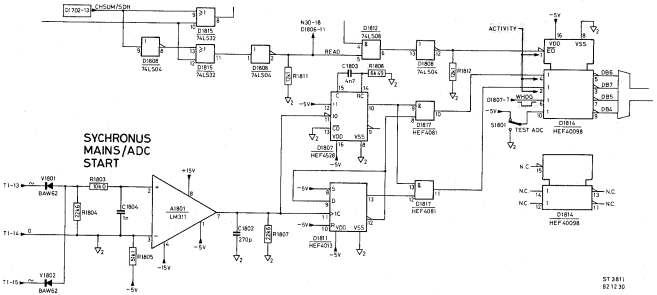


11.8. *TEST 5* Synchronous mains/ADC start circuit (No S.A.)

Preparations

- PM2528
  - Testrom placed in socket D1810 (both ROMs removed).
  - Analog control p.c.b. N20 removed.
  - Galvanic separation p.c.b. and interfaces (BCD, ANALOG, IEC) removed.
- Connect the test switch to the PM2528 (refer to 11.1.).
- Switch on the PM2528 and select *TEST 5*.
- Use a data probe or oscilloscope to measure the state of the signals.
  Logic 1 = 0V, logic 0 = –5V.



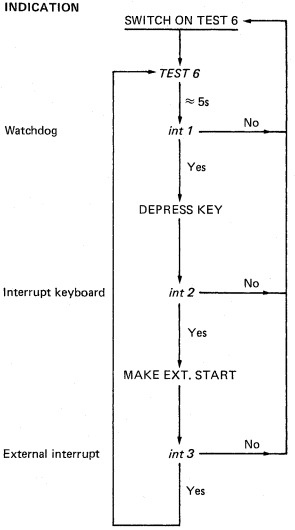

SYCHRONUS
MAINS/ADC
START
CHSUM/SDH
D1702-13
D1815
74LS32
D1808
74LS04
D1805
74LS32
D1808
74LS04
R1811
N30-18
D1808-11
READ
D1812
74LS08
C1803
4n7
R1806
68 k Ω
D1808
74LS04
R1812
ACTIVITY
VDD
VSS
DB6
DB7
DB5
DB4
D1807-7
WHDG
S1801
TEST ADC
D1816
HEF40098
D1807
HEF4081
D1817
HEF4081
D1811
HEF4013
T1-13
T1-14
T1-15
V1801
BAW62
V1802
BAW62
R1803
10k Ω
R1804
C1804
1n
R1805
A1801
LM311
+15V
-15V
C1802
270p
R1807
220Ω
N.C
D1814
HEF40098
ST 3811
82 12 30

11.9. *TEST 6* Interrupt controller (No S.A.)

Preparations

- PM2528
  - Testrom placed in D1810 socket (both ROMs removed).
  - Analog control p.c.b. N20 removed.
  - Galvanic separation p.c.b. and interfaces (BCD, ANALOG, IEC) removed.
- Connect the test switch to the PM2528 (refer to 11.1.).
- Switch on the PM2528 and select *TEST 6*.
- Use a data probe or oscilloscope to measure the state of the signals.
  Logic 1 = 0V, logic 0 = –5V.

INDICATION



Check: Signals WDOG, ENI
WHDOG and $\overline{INT}$ on activity.

Incorrect:
WDOG, do *TEST 0*
ENI, do *TEST 0*
WHDOG, do *TEST 5*
$\overline{INT}$, check D1811, D1817.

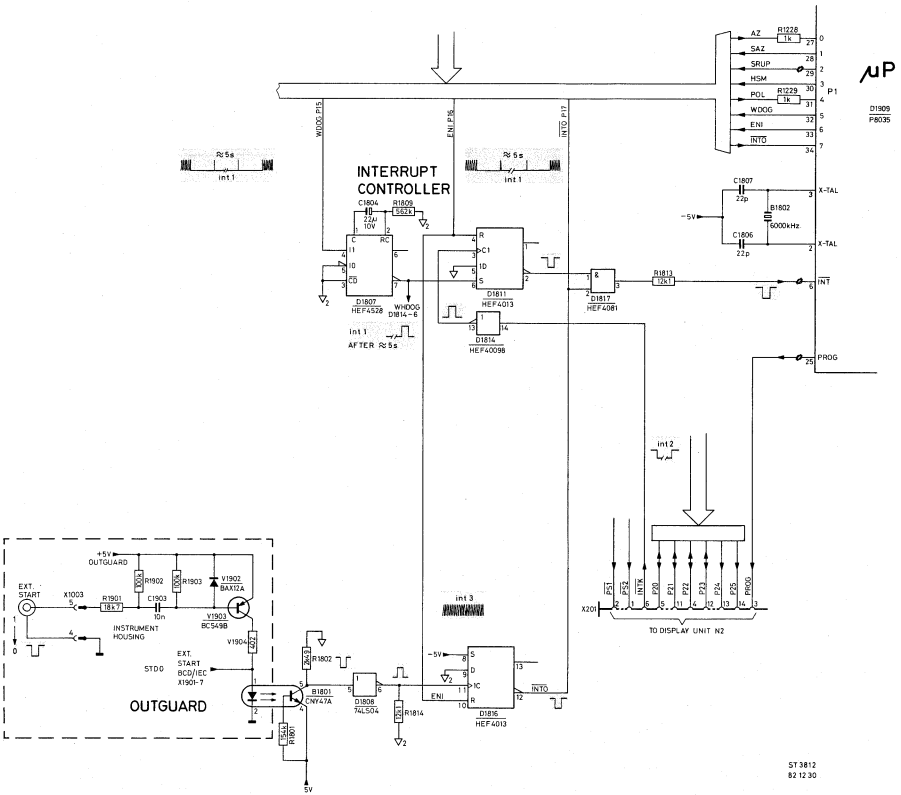
WHDOG is also connected to D1814/6

Check: Signals $\overline{INTK}$, ENI and
$\overline{INT}$ on activity.

Incorrect:
$\overline{INTK}$, do *TEST 2*
ENI, do *TEST 0*
$\overline{INT}$, check D1811, D1817.

Check: Signals EXT START, ENI
$\overline{INTO}$ and $\overline{INT}$ on activity.

Incorrect:
EXT START, check EXT start circuit
ENI, do *TEST 0*
$\overline{INTO}$, do *TEST 0*
$\overline{INT}$, check D1811, D1817


INTERRUPT CONTROLLER
μP
D1909
P8035
AZ
SAZ
SRUP
HSM
POL
WDOG
ENI
INTO
P1
R1228 1k
R1229 1k
C1807 22p
C1806 22p
B1802 6000kHz.
X-TAL
X-TAL
C1804 22μ 10V
R1809 562k
D1807 HEF4528
WHDOG D1814-6
int 1
AFTER ≈5s
≈5s
D1811 HEF4013
D1814 HEF4009B
D1817 HEF4081
R1813 12k1
INT
PROG
int 2
int 3
P51
P52
INTR
P20
P21
P22
P23
P24
P25
PROG
X201
TO DISPLAY UNIT N2
OUTGUARD
+5V OUTGUARD
EXT. START
X1003
R1901 18k7
C1903 10n
R1902 100k
R1903 100k
V1902 BAX12A
V1903 BC548
V1904
R1904 4k7
INSTRUMENT HOUSING
STDG
EXT. START BCD/IEC X1901-7
B1801 CNY47A
R1905 1k5
R1906 1k5
R1803 2k43
R1802
D1808 74LS04
R1814 10k1
D1816 HEF4013
ENI
INTO
5V
-5V
ST 3812
82 12 30

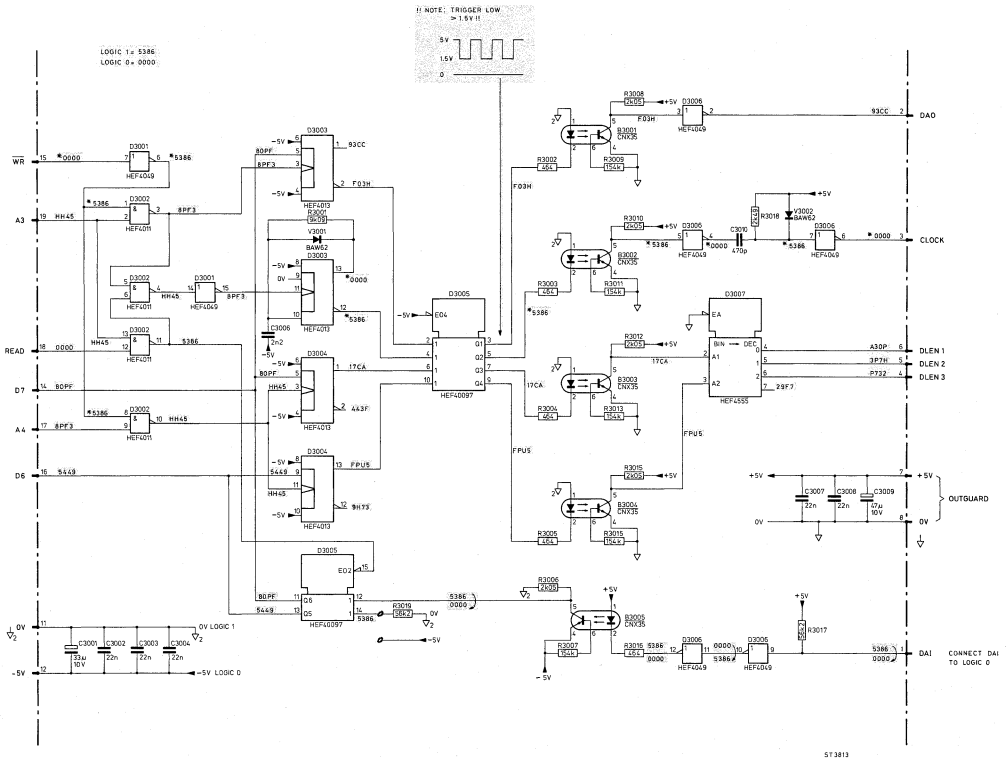
11.10. *TEST 7* Galvanic separation

Setting signature analyser

Setting	Edge	Test pin	Signal name
START	⌜	TP RUP	µp/P12 (SRUP)
STOP	⌟	TP RUP	µp/P12 (SRUP)
CLOCK	⌜⌟	TP $\overline{WR}$	µp/$\overline{WR}$
QUAL.	–	–	–
GROUND	–	TP –5V	Logic 0

Preparations

- PM2528
  - Testrom placed in D1810 socket (both ROMs removed).
  - Analog control p.c.b. N20 removed and replaced by extender p.c.b.
  - Galvanic separation p.c.b. N30 placed on extender p.c.b.
  - Interconnect N30/12 to N30 (Galvanic separation).
- Connect the signature analyser to the PM2528 as given in the settings table.
- Connect the test switch to the PM2528 (refer to 11.1.).
- Switch on the PM2528 and select *TEST 7*.


!! NOTE: TRIGGER LOW
> 1.5V !!
5V
1.5V
0
LOGIC 1 = 5386
LOGIC 0 = 0000
WR
A3
READ
D7
A4
D6
HEF4049
HEF4011
HEF4013
HEF4097
HEF4555
BAW62
BPF3
HH45
93CC
F03H
17CA
443F
FPU5
9H73
5449
5386
0000
DAO
CLOCK
DLEN 1
DLEN 2
DLEN 3
A3P
3P7H
P732
29F7
+5V
0V
OUTGUARD
DAI
CONNECT DAI
TO LOGIC 0
-5V LOGIC 0
0V LOGIC 1
ST3813
83 01 07

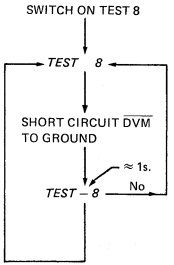
11.11. *TEST 8* BCD output PM9292, Start DVM (No S.A.)

Preparations

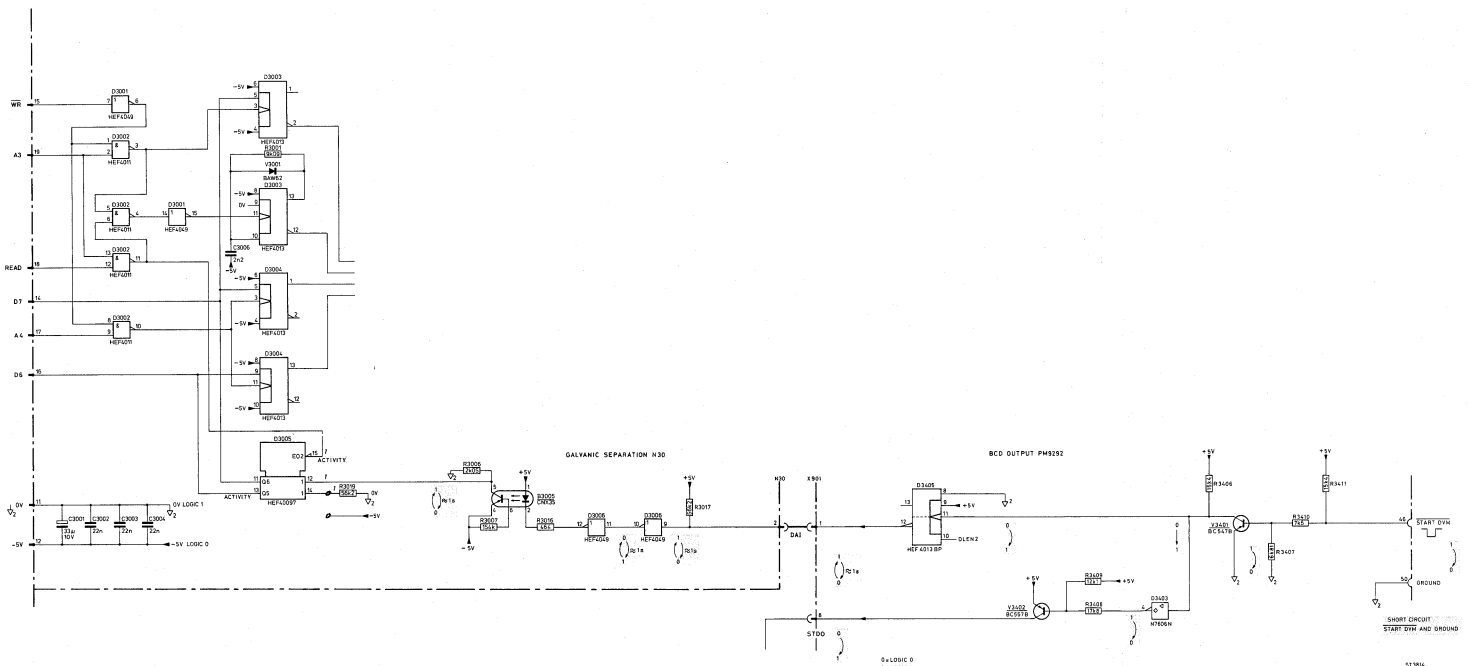
- PM2528
  - Test rom placed in D1810 socket (both ROMs removed).
  - Analog control p.c.b. N20 removed.
  - Galvanic separation p.c.b. N30 placed on extender p.c.b.
  - Interconnect N30/12 to N30/8 (Galvanic separation).
- Connect the test switch to the PM2528 (refer to 11.1.).
- Switch on the PM2528 and select test 8.
- Use a data probe or oscilloscope to measure the state of the signals.
  Logic 0 = –5V, logic 1 = 0V.

Indication

- If test 8 is switched on *TEST 8* will appear on the display.
- Short circuit signal $\overline{\text{START DVM}}$ and ground, on the display a dash will appear between TEST and 8 for about 1 second *(TEST – 8)*. This means that the µp has read the start dvm signal.
  If in-correct measure the state of the signals as given in the circuit diagram.



Check: State of signals as given in the circuit diagram.


WR
A3
READ
D7
A4
D6
0V
-5V
D3001
HEF4049
D3002
HEF4011
D3003
HEF4013
BA182
D3004
D3005
HEF4099
ACTIVITY
0V LOGIC 1
-5V LOGIC 0
C3001
C3002
C3003
C3004
GALVANIC SEPARATION N30
R3005
CNY39
R3002
CNY39
R3016
R3017
D3006
HEF4049
N30
X901
DA1
STOO
D3005
HEF 4013 BF
DLEN2
BCD OUTPUT PM9292
R3406
R3411
R3410
R3407
V3401
BC547B
V3402
BC557B
R3409
R3408
D3403
M7406N
START DYM
GROUND
SHORT CIRCUIT
START DYM AND GROUND
0 = LOGIC 0
1 = LOGIC 1
ST3814
83.01.07

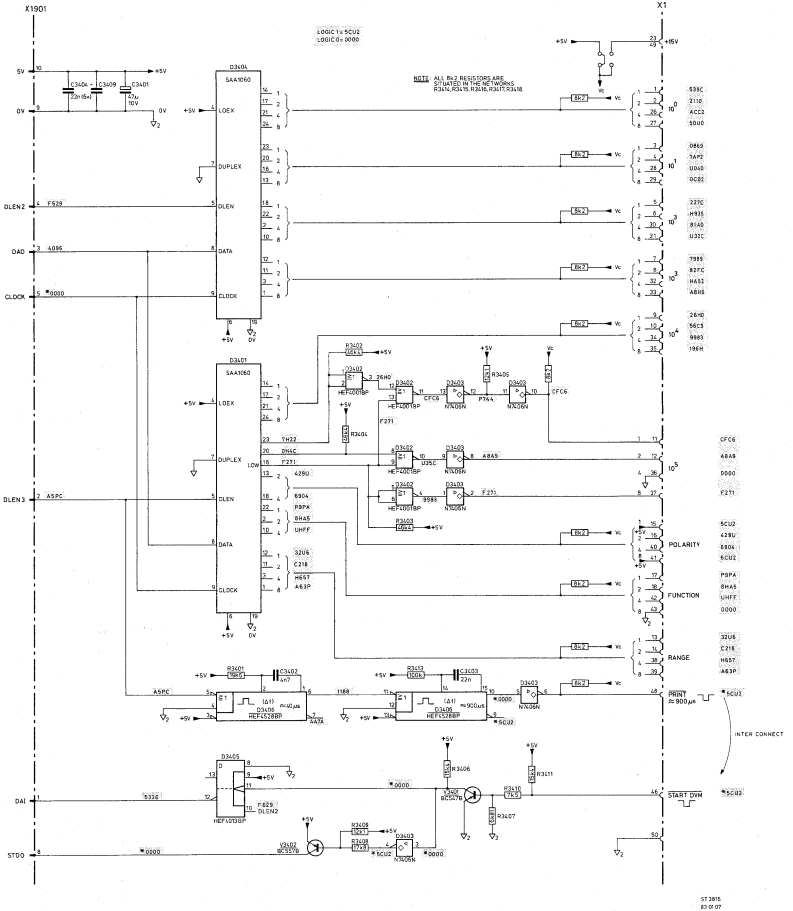
11.12. *TEST 9* BCD output PM9292

Setting signature analyser

Setting	Edge	Test pin	Signal name
START	⌝	TP RUP	µp/P12 (SRUP)
STOP	⌜	TP RUP	µp/P12 (SRUP)
CLOCK	⌜	TP $\overline{WR}$	µp/$\overline{WR}$
QUAL.	–	–	–
GROUND	–	TP –5V	Logic 0

Preparations

- PM2528
  - Testrom placed in D1810 socket (both ROMs removed).
  - Analog control p.c.b. N20 removed.
  - Galvanic separation p.c.b. N30 placed on extender p.c.b.
  - Interconnect N30/12 to N30/8 (Galvanic separation).
- Connect the signature analyser to the PM2528 as given in the settings table.
- Connect the test switch to the PM2528 (refer to 11.1.).
- Switch on the PM2528 and select *TEST 9*.



ST 3815
80 01 07

11.13. *TEST 10* Analog output PM9254

TEST10-A Input part.

Settings signature analyser

Setting	Edge	Test pin	Signal name
START	⌐	TP RUP	µp/P12 SRUP
STOP	⌐	TP RUP	µp/P12 SRUP
CLOCK	⌐	TP $\overline{WR}$	µp/$\overline{WR}$
QUAL.	–	–	–
GROUND	–	TP –5V	Logic 0

Preparations

- PM2528
  - Testrom placed in D1810 socket (both ROMs removed).
  - Analog control p.c.b. N20 removed and replaced by extender p.c.b.
  - Galvanic separation p.c.b. N30 placed on extender p.c.b.
  - Interconnect N30/12 to N30/8 (Galvanic separation).
- PM9254 – Set digit switch in position C (refer to rear of PM2528).
- Connect the signature analyser to the PM2528 as given in the settings table.
- Connect the test switch to the PM2528 (refer to 11.1.).
- Switch on the PM2528 and select *TEST 10*.

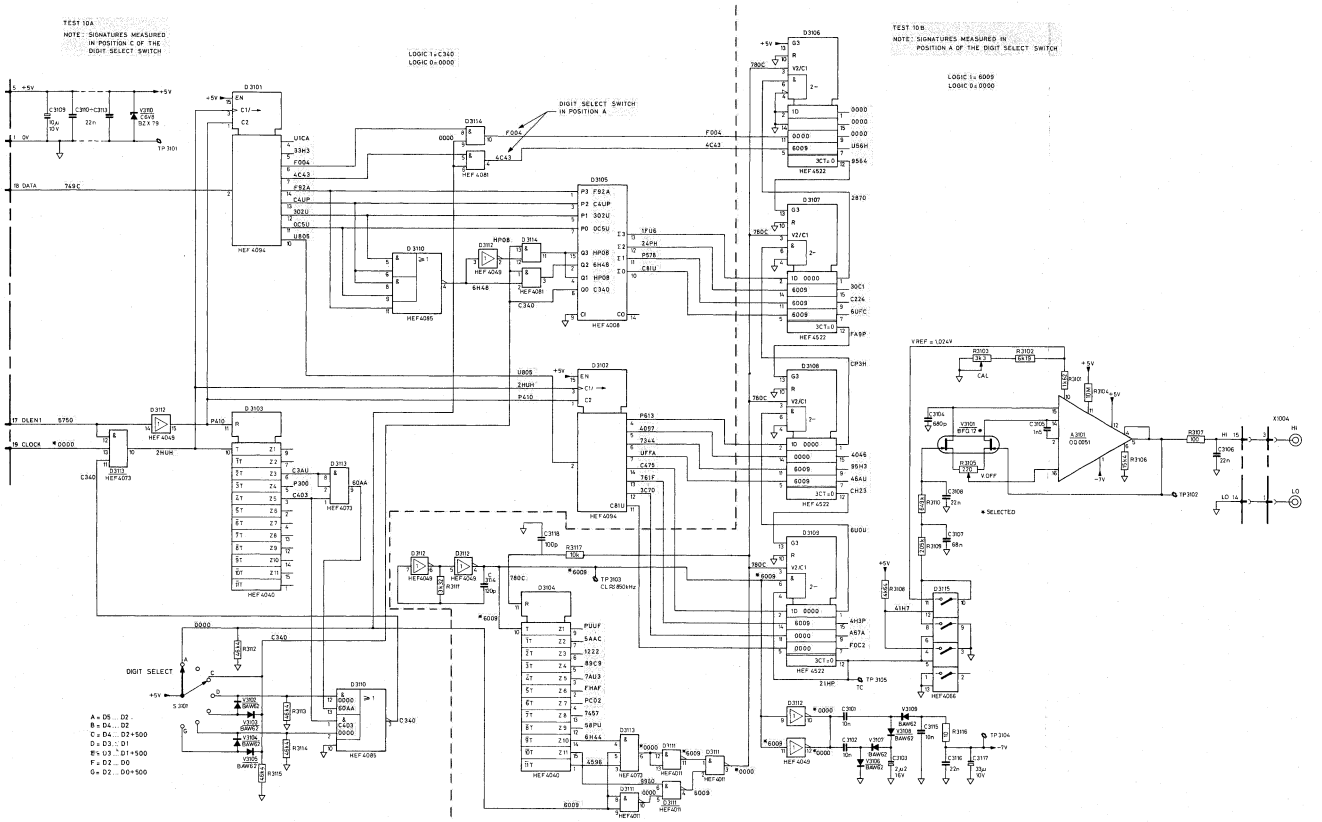
TEST 10-B Output part (Self running, with own clock).

Settings signature analyser

Setting	Edge	Test pin	Signal name
START	⌐	D3111/3	Load
STOP	⌐	D3111/3	Load
CLOCK	⌐	TP3103	Clock
QUAL.	–	–	–
GROUND	–	TP –5V	Logic 0

Preparations

- PM2528 – Refer to test 10A.
- PM9254 – Set the digit select switch in position A (refer to rear of the PM2528).
- Connect the signature analyser to the PM2528 as given in the settings table.
- Connect the test switch to the PM2528 (refer to 11.1.).
- Switch on the PM2528 and select *TEST 10*.


TEST 10A
NOTE : SIGNATURES MEASURED IN POSITION C OF THE DIGIT SELECT SWITCH
LOGIC 1 = C340
LOGIC 0 = 0000
TEST 10B
NOTE : SIGNATURES MEASURED IN POSITION A OF THE DIGIT SELECT SWITCH
LOGIC 1 = 6009
LOGIC 0 = 0000
DIGIT SELECT SWITCH IN POSITION A
DIGIT SELECT
A = D5 .. D2 .
B = D4 .. D2 .
C = D4 .. D2 + 500
D = D3 .. D1 .
E = D3 .. D1 + 500
F = D2 .. D0 .
G = D2 .. D0 + 500
SWITCH DECODER
D3110 | A | B | C | D | E | F | G
12 | 0000 | 0000 | 0000 | C340 | C340 | 0000 | 0000
13 | 60AA | 60AA | 60AA | 60AA | 60AA | 0000 | 0000
1 | C403 | C403 | C403 | C403 | C403 | C403 | C403
2 | 0000 | 0000 | 0000 | 0000 | 0000 | C340 | C340
3 | C340 | C340 | C340 | H3PA | H3PA | 0743 | 0743
ST3816
83 0107

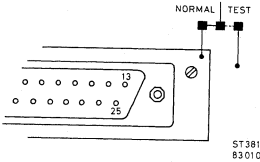
11.14. *TEST 11* IEC-BUS PM9291 (without address decoder)

Settings signature analyser

Setting	Edge	Test pin	Signal name
START	⌐	TP RUP	µp/P12 (SRUP)
STOP	⌐	TP RUP	µp/P12 (SRUP)
CLOCK	⌐	N20/12	µp/P10 AZ
QUAL.	–	–	–
GROUND	–	TP –5V	Logic 0

Preparations

- PM2528
  - Testrom placed in D1810 socket (both ROMs removed).
  - Analog control p.c.b. N20 removed and replaced by extender p.c.b.
  - Galvanic separation p.c.b. N30 placed on extender p.c.b.
  - Inter-connect N30/12 to N30/8 (Galvanic separation).
- PM9291
  - Jumper on the interface in position test



  - Interconnect on the IEC-BUS connector
    signal DAV with EOI,
    signal REN with ground

- Connect the signature analyser to the PM2528 as given in the settings table.
- Connect the test switch to the PM2528 (refer to 11.1.).
- Switch on the PM2528 and select *TEST 11*.

TEST ADDRESS DECODER (Self-running with own clock).

Settings signature analyser

Setting	Edge	Test pin	Signal name
START	⌐	D3210/9	red
STOP	⌐	D3210/9	red
CLOCK	⌐	D3216/15	CI
QUAL.	–	–	–
GROUND	–	TP –5V	Logic 0

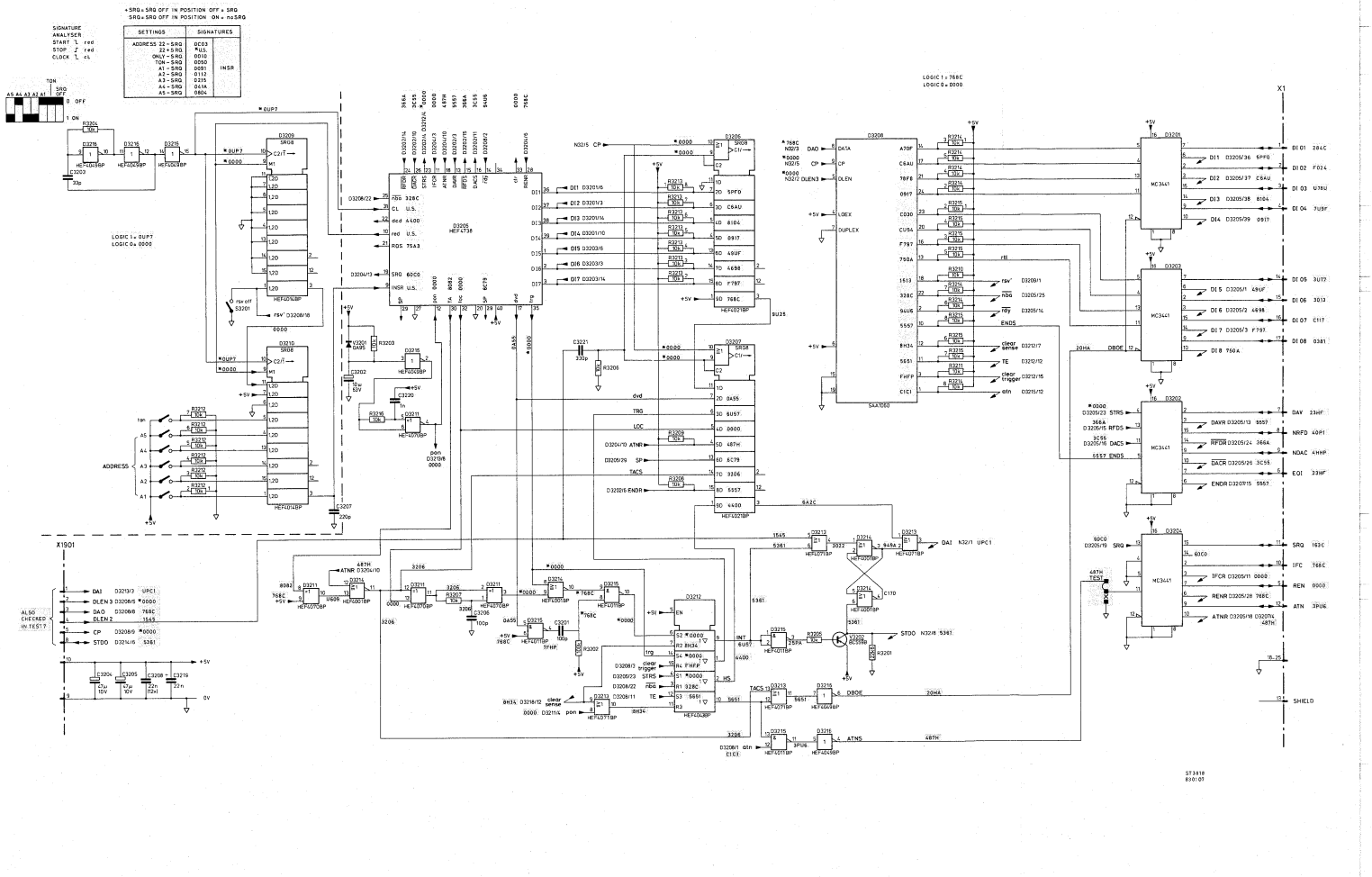
Preparations
Refer to test 11.

How to measure signal INSR (D3210/3) LOGIC 1 = 0UP7

Measuring sequence

	Settings			Sequence
1	Address	22	– SRQ	0C03
2	Address	22	+ SRQ	US* (Unstable)
3	Only		– SRQ	0010
4	Only	TON	– SRQ	0050
5	Only	A1	– SRQ	0091
6	Only	A2	– SRQ	0112
7	Only	A3	– SRQ	0215
8	Only	A4	– SRQ	041A
9	Only	A5	– SRQ	0804

+SRQ = SRQ off in position off = SRQ
SRQ = SRQ off in position on = SRQ


+SRQ+SRQ OFF IN POSITION OFF +SRQ
SRQ+SRQ OFF IN POSITION ON +noSRQ
SETTINGS
SIGNATURES
ADDRESS 22 +SRQ
22 +SRQ
ONLY +SRQ
TON +SRQ
A1 +SRQ
A2 +SRQ
A3 +SRQ
A4 +SRQ
A5 +SRQ
DC03
*LL
0010
0050
0081
INSR
0112
0215
0414
0804
SIGNATURE ANALYSER
START L red
STOP Z red
CLOCK L cl
TON
SRQ OFF
0 OFF
1 ON
A5 A4 A3 A2 A1
LOGIC 1 = 0UP7
LOGIC 0 = 0000
rsv off S3201
rsv' D3208/18
ADDRESS
LOGIC 1 = 768C
LOGIC 0 = 0000
D3206 HEF4738
D3207 SR08
D3208 SR08
D3209 SR08
D3210 SR08
D3202 MC3441
D3203 MC3441
D3204 MC3441
D3205 MC3441
SAA1060
HEF4028BP
HEF4049BP
HEF4070BP
HEF4071BP
HEF4011BP
HEF4001BP
HEF4017BP
HEF4075BP
HEF4042BP
HEF4081BP
HEF4030BP
HEF4077BP
HEF4001T
HEF4070T
HEF4011T
HEF4017T
HEF4042T
HEF4081T
HEF4030T
HEF4077T
X1
X1901
AL50 CHECKED IN TEST 7
SHIELD
DI 01 284C
DI 02 F024
DI 03 U78U
DI 04 7U9F
DI 05 3U77
DI 06 3013
DI 07 C117
DI 08 0381
DAV 23HF
NRFD 40P1
NDAC 4HHP
EOI 23HF
SRQ 163C
IFC 768C
REN 0900
ATN 3PU6
ATNR D3204/10 487H
ST3818 8:01:07